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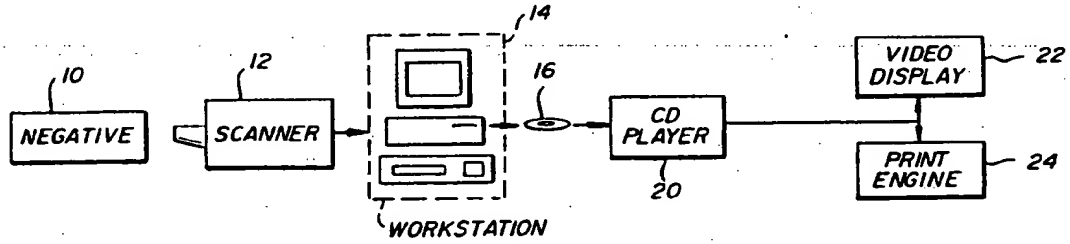

(57) Abstract

The "viewing delay" encountered when accessing a digital image from a relatively high resolution database stored using a digital storage device with a relatively slow transfer rate, such as a compact disc, is substantially reduced by a readout and display control mechanism that rapidly provides the viewer with an initially relatively low resolution image and thereafter increases the resolution of the displayed image. By presenting the viewer with such a "quick-view" low resolution image, the present invention enables the viewer to determine whether the image being displayed is of interest, so that the viewer has the immediate option of calling up another stored image or permitting the currently displayed low resolution image to be iteratively enhanced, so as to obtain a higher resolution image.

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+ DESIGNATIONS OF "SU"

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MECHANISM FOR ACCESSING DIGITIZED IMAGE DATABASE TO PROVIDE ITERATIVELY IMPROVED DISPLAY RESOLUTION

FIELD OF THE INVENTION

The present invention relates in general to digitized image data processing systems and is particularly directed to a mechanism for accessing the contents of a two-dimensional image-representative database and rapidly displaying an image the resolution of which is iteratively increased during successive scans of the database.

BACKGROUND OF THE INVENTION

Digital imaging systems, such as those employed for converting still color photographic slides into a digital format for display on a color television monitor, customarily encode the output of an electronic imaging device, such as a digital color camera, to some prescribed resolution and store the encoded image in an associated database as a respective image file on a digital storage medium. When it is desired to display a particular stored image, the contents of the respective addresses of the database in which the digitized image has been stored are read out and coupled to display driver circuitry for energizing corresponding pixels of a display device.

With continuing improvements in digital storage media density and recording technology, it has been possible to increase both the image capacity and resolution of the digital database, so that the image quality produced from the image database, by means of a high resolution output device, such as a high definition color display or high resolution thermal printer, is substantially indistinguishable from the quality produced by directly linking the digital color

camera to the output device. Unfortunately, coupling the stored image in the database to the output device cannot take place instantaneously; the contents of the respective addresses of the database must be clocked out to the corresponding pixels of the display. Even with the improved operational speed of present day digital storage media, there is some finite access time associated with each digital byte of information used to represent the image, so that as the size of the image array is increased in order to provide a higher resolution output image, the length of time required to access the entire image necessarily increases. As a consequence, in applications where the data rate of the digital storage device is fixed at a relatively moderate speed, for example at the 167.4 kbytes/sec rate of current compact disc players, an individual desiring to view a stored high resolution image, for example a 2048 X 3072 (2K by 3K) pixel array, must wait while a read-out clock that is compatible with the operational speed of the digital storage device (CD player) calls up from memory each of the data entries associated with the respective pixels of the image. Obviously, the higher the image resolution, the longer it takes for the image to be displayed. Thus, should the viewer wish to "electronically thumb through" a plurality of images or even identify a single image on the disc, the slow access time constitutes a major hindrance to that effort, which is particularly objectionable due to the extremely fast response time of the human visual system.

In accordance with the present invention, the considerable "viewing delay" encountered in accessing a digital image from a relatively high resolution database using a conventional sequential data access scheme is substantially reduced by a readout and

display control mechanism that rapidly provides the viewer with an initially relatively low resolution image and thereafter automatically increases the resolution of the displayed image. By presenting the viewer with such a "quick-view" image, the present invention enables the viewer to determine whether the image being displayed is of interest, so that the viewer has the immediate option of calling up another stored image or permitting the currently displayed low resolution image to be iteratively enhanced.

To this end the present invention incorporates a memory addressing mechanism through which first partitioned data entries of the image database, which are respectively associated with a two-dimensional sub-array of R X S picture elements of the image and the spatial resolution of which is less than that of the M X N picture elements of the display, are sequentially accessed at the transfer rate of the digital storage device (e.g. the above-referenced 167.4 kbytes/sec rate of a compact disc player) and stored in a corresponding sub-array of R X S pixels in the playback device. Because, the size of the R X S sub-array is a fraction (e.g. one-fourth) of the M X N picture elements of the display, it is necessary to interpolate the remaining (adjacent) display pixels. To simplify processing, the interpolation mechanism is preferably executed by replicating each accessed data value for one or more adjacent pixels, so that each respective pixel of image data from the first partitioned picture region R X S sub-array, is initially coupled to a selected plurality (e.g. four) of display pixels, thereby rapidly providing the viewer with a low resolution image.

Thereafter, as database read-out continues, additional partitioned R X S sub-arrays of data

entries, associated with pixels whose values were originally replicated from the first R X S sub-array are accessed, so that successive sub-arrays of (replicated) pixel values are iteratively replaced by actual data values from the database. After a plurality (e.g. four) of the R X S sub-arrays are read out from database into the playback device, at the CD player's (low speed) transfer rate, this successive sub-array replacement operation will result in a final display having an increased resolution image.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 diagrammatically illustrates a photographic color slide processing system in which the present invention may be employed;

Figure 2 diagrammatically shows a 512 row by 768 column array of image picture elements (pixels);

Figure 3 diagrammatically shows the sub-array components of an 8 X 8 pixel image;

Figure 4 diagrammatically illustrates replicating each accessed data value for a plurality of four adjacent pixels;

Figures 5, 6 and 7 diagrammatically illustrate the iterative updating of the output image obtained by sequentially accessing the four partitioned sub-arrays of the image database of Figure 3.

Before describing in detail the iteratively increased resolution database access and display mechanism in accordance with the present invention, it should be observed that the present invention resides primarily in a novel structural combination of conventional image processing circuits and components and not in the particular detailed configurations thereof. Accordingly, the structure, control and

arrangement of these conventional circuits and components have been illustrated in the drawings by readily understandable block diagrams which show only those specific details that are pertinent to the present invention, so as not to obscure the disclosure with structural details which will be readily apparent to those skilled in the art having the benefit of the description herein. Thus, the block diagram illustrations of the drawings do not necessarily represent the mechanical structural arrangement of the exemplary system, but are primarily intended to illustrate the major structural components of the system in a convenient functional grouping, whereby the present invention may be more readily understood.

Figure 1 diagrammatically illustrates a photographic color film processing system in which the present invention may be employed. For purposes of the present description such a system may be of the type described, for example, in co-pending Patent application Serial Number_____, filed _____, by S. Kristy, entitled "Multiresolution Digital Imagery Photofinishing System," assigned to the assignee of the present application and the disclosure of which is incorporated herein. However, it should be observed that the system described in the above-referenced co-pending application is merely an example of one type of system in which the invention may be used and is not to be considered limitative of the invention. In general, the invention may be incorporated in any digitized imagery processing system.

In accordance with the digital image processing system of Figure 1, photographic images, such as those captured on 35mm negatives 10, are scanned by a high resolution opto-electronic film scanner 12, such as a commercially available Eikonix

Model 1435 scanner. Scanner 12 outputs digitally encoded data representative of the response of its image sensing array onto which the photographic image contained on a respective color negative is projected. This digitally encoded data, or "digitized" image, is coupled in the form of an imaging pixel array-representative bit map to an attendant image processing workstation 14, which contains a frame store and image processing application software through which the digitized image may be processed (e.g. enlarged, rotated, cropped, subjected to scene color balance correction, etc.) to achieve a desired image appearance. Once an image file has been prepared, it is written onto a transportable medium, such as an optical compact disc 16, for subsequent playback by a disc player 20 which allows the image to be displayed, for example, on a relatively moderate resolution consumer television set 22, or printed as a finished color print, using a high resolution thermal color printer 24.

In accordance with the image processing system described in the above referenced co-pending application, each captured image is stored as a respective image data file in the form of a low resolution image bit map file and a plurality of residual images associated with respectively different degrees of image resolution. By iteratively combining successive residual images with the low resolution image, successively increased resolution images may be recovered from the low resolution image for application to a readout device such as a color video display or hard copy printer.

As an example, the low resolution bit map file to which the original high resolution image is reduced may comprise a 512 row by 768 column array of

pixel values, as diagrammatically shown in Figure 2, and such that there is substantially a one-for-one correspondence between the spatial values of the low resolution image array and the pixels of an associated display, such as the 480 X 640 "square pixel" display capability of an NTSC television receiver, where the center 480 rows and 640 columns of the database pixels correspond, one-for-one, with the display pixels. The stored 512 row by 768 column image is preferably formatted into a plurality (e.g. four) partitioned sub-arrays, respective image locations of which are immediately adjacent to one another, so as to form an array of contiguous image components. For the example of formatting a 512 X 768 array into four partitioned sub-arrays, the database may be considered to comprise a 256 X 384 array of "blocks-of-four" image components 1, 2, 3 and 4, several of which are shown in Figure 2. In order to simplify the illustrations in the drawings, rather than treat the parameters of a 512 X 768 image array, the discussion to follow will treat an image comprised of eight rows R1...R8 and eight columns C1...C8 of image values, as diagrammatically shown in Figure 3. It should be observed that the example of an 8 X 8 image is merely for purposes of simplifying the description and illustration and, like the 512 X 768 pixel image, referenced above, is not to be considered limitative of the invention.

The 8 X 8 pixel image of Figure 3 is depicted as comprising a 4 X 4 array of partitioned "blocks-of-four" image blocks B1...B16, each of which contains four adjacent pixels. Image block B1 contains pixels 1-1, 1-2, 1-3 and 1-4. Similarly, image block B2 contains pixels 2-1, 2-2, 2-3 and 2-4, and so on, down through block B16, which contains pixels 16-1, 16-2, 16-3 and 16-4.

In accordance with the database accessing scheme employed by the present invention, during the initial read-out of the database, only one of the partitioned sub-arrays of pixels (1-1...1-16) is accessed for the purpose of regenerating the entire image (all four pixels in each of blocks B1...B16). Thereafter, the remaining "replicated" entries of the image are successively "filled-in" with their true values, until the image is completed.

More particularly, when a digitized image read out by CD player in Figure 1 from compact disc 16 is to be displayed on video display 22, the first partitioned sub-array of pixel values (1-1...1-16 in Figure 3) is transferred to a video framestore resident in CD player 20. As the first sub-array of pixels is transferred and stored in the CD player framestore, the framestore is addressed so as to store the respective entries of only one of its low resolution sub-arrays, such as 4 X 4 sub-array 1, containing sub-array data entries 1-1...1-16. Because the size of the first partitioned sub-array is only a fraction (here, one-fourth) of the size of the display array, it is necessary to interpolate the remaining (adjacent) display pixels. To simplify processing, the interpolation mechanism is preferably executed by replicating each pixel value of the first partitioned sub-array for one or more adjacent pixels, as diagrammatically illustrated in Figure 4, so that each respective pixel of the first partitioned sub-array (1-1...1-16) is initially coupled to a selected plurality (here four) of display pixels, thereby rapidly providing the viewer with a low resolution image. In terms of the parameters of the 512 X 768 pixel bit-mapped image file referenced above and a 480 X 640 pixel display, what is initially displayed is a "lower"

resolution display of 240 X 320 independent image data values that occupy or "fill" the overall 480 X 640 pixel matrix of the color display device. While the 240 X 320 displayed image is not a "high" (e.g. 2048 X 3072) resolution image, or even a low resolution image equivalent to the 480 X 640 resolution of the color TV monitor, it has sufficient definition to permit the viewer to decide whether to leave the image on the screen or to call up another image.

Thereafter, as diagrammatically represented by the sequence illustrated in Figures 5, 6 and 7, during subsequent reading of the database in accordance with the data transfer rate of the CD player, additional partitioned sub-arrays 2, 3 and 4, which contain the true values of the originally replicated pixels in the array of Figure 4, are called up, so that successive sub-arrays of replicated pixel values within the displayed image are replaced by their true data values. Thus, after the plurality (here four) of partitioned sub-arrays have been read from the database at the slow CD data transfer rate, the successive sub-array replacement process will result in a finally displayed "increased" resolution image. The phrase "increased" resolution image is intended to mean an image whose resolution is greater than that originally presented using only the first partitioned sub-array, as shown in Figure 4. For example, in the case of the 512 X 768 pixel bit-mapped database image, the originally displayed image is a 240 X 320 pixel image, while the final "increased" resolution image is a 480 X 640 pixel image. The "increased" resolution image is not necessarily the maximum resolution image available after iterative residual processing of the bit-mapped image within the original database which provides a "high" resolution image, for example a 2048 X 3072

pixel image suitable for producing a high quality color print.

As will be appreciated from the foregoing description, by rapidly providing the viewer with an initially relatively low resolution image and thereafter iteratively increasing the resolution the displayed image, the present invention is able to substantially reduce the considerable "viewing delay" encountered when accessing a digital image from a relatively high resolution database using a conventional sequential low speed data transfer scheme. By presenting the viewer with such a "quick-view" image, the present invention enables the viewer to determine whether the image being displayed is of interest, so that the viewer has the immediate option of calling up another stored image or permitting the currently displayed low resolution image to be iteratively enhanced.

While we have shown and described an embodiment in accordance with the present invention, it is to be understood that the same is not limited thereto but is susceptible to numerous changes and modifications as known to a person skilled in the art, and we therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are obvious to one of ordinary skill in the art.

Claims:

1. For use with an image-representative data base, respective data storage locations of which contain image data associated with the respective locations of a two-dimensional M X N array of pixels of said image, a method of displaying said image on a display device, said display device containing a J X K array of picture elements, comprising the steps of:

(a) accessing, from said image-representative data base, image data associated with selected first sub-array of said M X N array; and

(b) coupling respective components of imagery data accessed in step (a) to a selected first sub-array of said J X K array, so that said display device displays said image at a resolution that is reduced by the spatial selectivity of said first sub-array of said M X N array.

2. A method according to claim 1, further including the steps of:

(c) subsequently accessing, from said image-representative data base, imagery data associated with a selected second sub-array of said M X N array; and

(d) coupling image data accessed in step (c) to a selected second sub-array of said J X K, so as to increase the resolution at which said display device displays said image.

3. A method according to claim 2, wherein step (b) comprises coupling the respective values of image data associated with said selected first sub-array of said M X N array accessed in step (a), to a selected plurality of pixels of said J X K array.

4. A method according to claim 2, further including the steps of:

(e) accessing, from said image-representative data base, image data associated with a selected third sub-array of said M X N array; and

(f) coupling image data accessed in step (e) to selected third sub-array of said J X K array among first regions thereof, so as to further increase the resolution at which said display device displays said image.

5. A method according to claim 4, and wherein step (b) comprises coupling the respective values of image data associated with said selected first sub-array of said M X N array accessed in step (a) to a selected plurality of first pixels of said J X K array.

6. A method according to claim 1, wherein, for the J X K array of picture elements of said display device, J=M and K=N.

7. For use with a two-dimensional image-representative data base having a plurality of data entries, each data entry being associated with a respective pixel of a two-dimensional array of M X N pixels that make up said image, a method of controlling the energization of an array of J X K pixels of a display device, so that said display device displays a representation of said image, comprising the steps of:

(a) accessing a first set of data entries of said data base which are respectively associated with a two-dimensional array of R X S pixels of said image and the spatial resolution of which is less than that of said M X N pixels; and

(b) energizing respective ones of R X S pixels of the array of J X K pixels of said display device in accordance with respective first selected data entries of said data base accessed in step (a).

8. A method according to claim 7, wherein the spatial resolution of said array of R X S pixels is less than the spatial resolution of said array of J X K pixels.

9. A method according to claim 7, wherein step (b) comprises coupling a respective image data value associated with a respective pixels of said set of first pixels of said R X S array accessed in step (a), to a selected plurality of pixels said J X K array.

10. A method according to claim 7, further including the steps of:

(c) accessing a second set of data entries of said data base which are respectively associated with a two-dimensional array of P X Q pixels of said image and the spatial resolution of which is less than that of said M X N pixels; and

(d) energizing respective ones of P X Q pixels of the array of J X K pixels of said display device in accordance with a respective second set of data entries of said data base accessed in step (c).

11. A method according to claim 10, further including the steps of:

(e) accessing a third set of data entries of said data base which are respectively associated with a two-dimensional array of C X D pixels of said image and the spatial resolution of which is less than that of said M X N pixels; and

(f) energizing respective ones of C X D pixels of the array of J X K pixels of said display device in accordance with a respective third set of data entries of said data base accessed in step (e).

12. For use with a two-dimensional image-representative data base having a plurality of data entries, each data entry being associated with a

respective picture region of a two-dimensional array of M X N picture regions that make up said image, a method of controlling the energization of an array of M X N pixels of a display device, so that said display device displays a representation of said image comprising the steps of:

(a) accessing first selected data entries of said data base which are respectively associated with a two-dimensional array of R X S picture regions of said image and the spatial resolution of which is less than that of said M X N picture regions; and

(b) energizing respective ones of R X S pixels of the array of M X N pixels of said display device in accordance with respective first selected data entries of said data base accessed in step (a).

13. A method according to claim 12, wherein step (b) comprises coupling a respective component of imagery data, associated with a respective one of said selected first picture regions of said R X S array accessed in step (a), to a selected plurality of first picture elements of said M X N array.

14. A method according to claim 13, further including the steps of:

(c) accessing second selected data entries of said data base which are respectively associated with a two-dimensional array of P X Q picture regions of said image and the spatial resolution of which is less than that of said M X N picture regions; and

(d) energizing respective ones of P X Q pixels of the array of M X N pixels of said display device in accordance with respective second selected data entries of said data base accessed in step (c).

15. A method according to claim 14, further including the steps of:

(e) accessing third selected data entries of said data base which are respectively associated with a two-dimensional array of C X D picture regions of said image and the spatial resolution of which is less than that of said M X N picture elements; and

(f) energizing respective ones of C X D pixels of the array of M X N pixels of said display device in accordance with respective third selected data entries of said data base accessed in step (e).

16. A method according to claim 15, further including the steps of:

(g) accessing fourth selected data entries of said data base which are respectively associated with a two-dimensional array of J X K picture regions of said image and the spatial resolution of which is less than that of said M X N picture elements; and

(h) energizing respective ones of J X K pixels of the array of M X N pixels of said display device in accordance with respective fourth selected data entries of said data base accessed in step (g).

17. For use with a two-dimensional image-representative data base having a plurality of data entries, each data entry being associated with a respective picture region of a two-dimensional array of M X N picture regions that make up said image, a method of controlling the energization of an array of M X N pixels of a display device, so that said display device displays a representation of said image comprising the steps of:

(a) accessing first selected data entries of said data base which are respectively associated with a two-dimensional sub-array of R X S picture regions distributed among the M X N picture regions of said image, such that the spatial resolution of said R X S picture regions is less than that of said M X N picture

regions; and

(b) energizing respective ones of an R X S sub-array of pixels of the array of M X N pixels of said display device in accordance with respective first selected data entries of said data base accessed in step (a).

18. A method according to claim 17, wherein step (b) comprises coupling a respective component of imagery data, associated with a respective one of said selected first picture regions of said R X S sub-array accessed in step (a), to a selected plurality of first picture elements of said M X N array.

19. A method according to claim 18, wherein the number of first picture elements of said selected plurality corresponds to the ratio of M X N picture elements to R X S picture elements.

20. A method according to claim 19, further including the steps of:

(c) accessing second selected data entries of said data base which are respectively associated with a two-dimensional sub-array of P X Q picture regions distributed among the M X N picture regions of said image, such that the spatial resolution of said P X Q picture regions is less than that of said M X N picture regions; and

(d) energizing respective ones of a sub-array of P X Q pixels distributed among the array of M X N pixels of said display device in accordance with respective second selected data entries of said data base accessed in step (c).

21. A method according to claim 20, further including the steps of:

(e) accessing third selected data entries of said data base which are respectively associated with a two-dimensional sub-array of C X D picture regions of

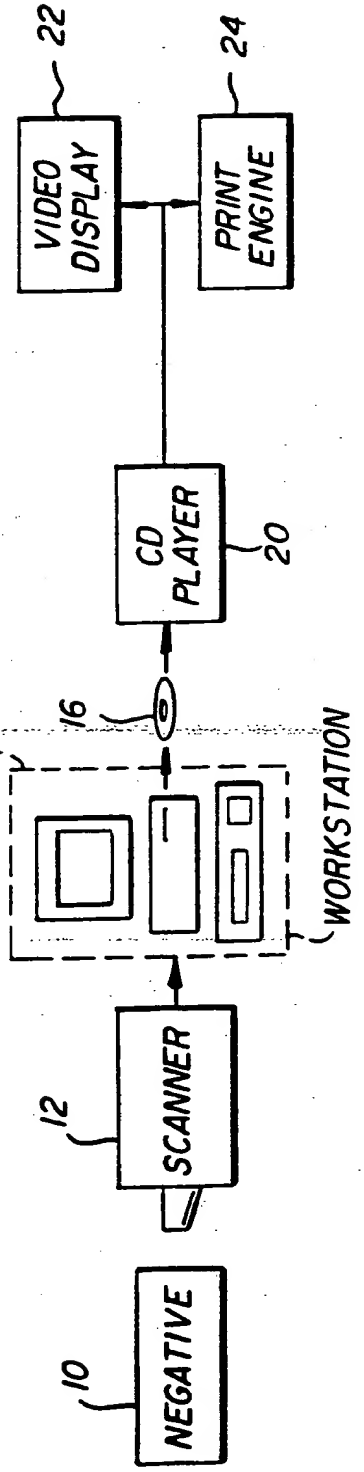
said image distributed among the M X N picture regions of said image, such that the spatial resolution of said C X D picture regions is less than that of said M X N picture regions; and

(f) energizing respective ones of a sub-array of C X D pixels distributed among the array of M X N pixels of said display device in accordance with respective third selected data entries of said data base accessed in step (e).

22. A method according to claim 21, further including the steps of:

(g) accessing fourth selected data entries of said data base which are respectively associated with a two-dimensional sub-array of J X K picture regions of said image distributed among the M X N picture regions of said image, such that the spatial resolution of said J X K picture regions is less than that of said M X N picture regions; and

(h) energizing respective ones of a J X K sub-array of pixels distributed among the array of M X N pixels of said display device in accordance with respective fourth selected data entries of said data base accessed in step (g).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SCANNER
12
WORKSTATION
14
16
CD PLAYER
20
VIDEO DISPLAY
22
PRINT ENGINE
24

FIG. 1

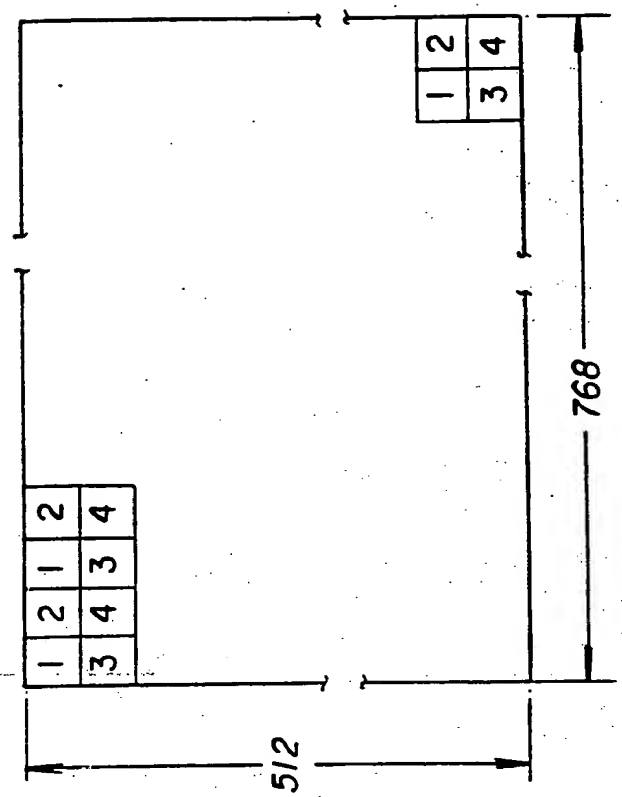
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
512
768

FIG. 2

	C1	C2	C3	C4	C5	C6	C7	C8
R1	1-1	2-1	1-2	2-2	1-3	2-3	1-4	2-4
R2	3-1	4-1	3-2	4-2	3-3	4-3	3-4	4-4
R3	1-5	2-5	1-6	2-6	1-7	2-7	1-8	2-8
R4	3-5	4-5	3-6	4-6	3-7	4-7	3-8	4-8
R5	1-9	2-9	1-10	2-10	1-11	2-11	1-12	2-12
R6	3-9	4-9	3-10	4-10	3-11	4-11	3-12	4-12
R7	1-13	2-13	1-14	2-14	1-15	2-15	1-16	2-16
R8	3-13	4-13	3-14	4-14	3-15	4-15	3-16	4-16

FIG. 3

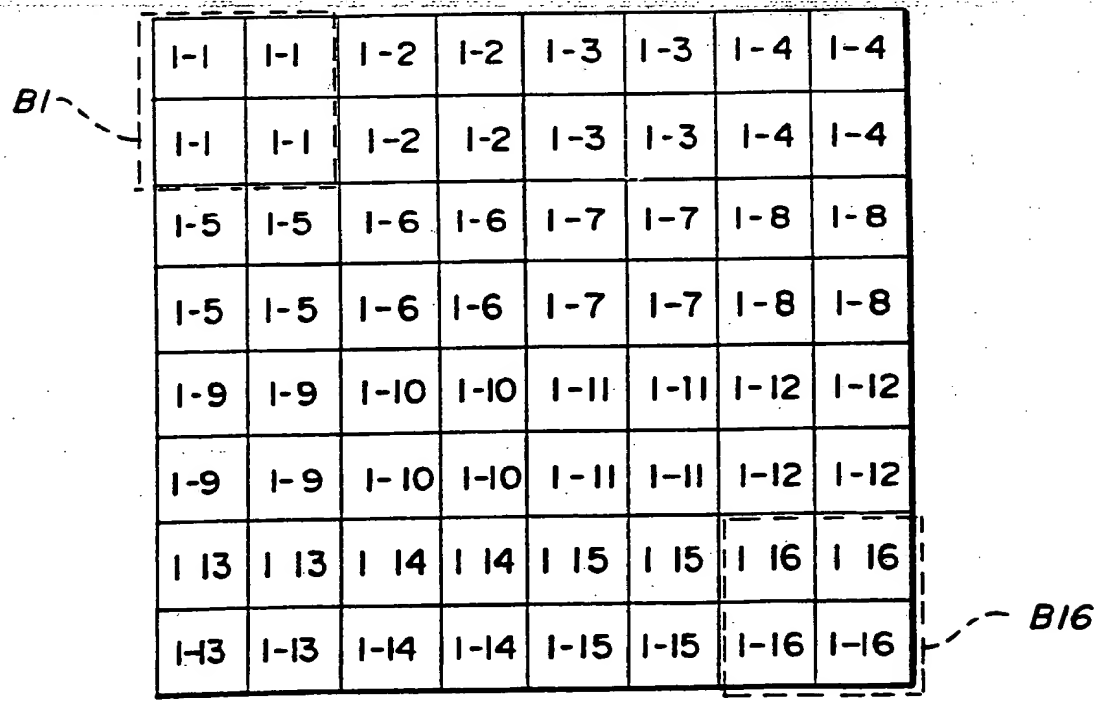

FIG. 4

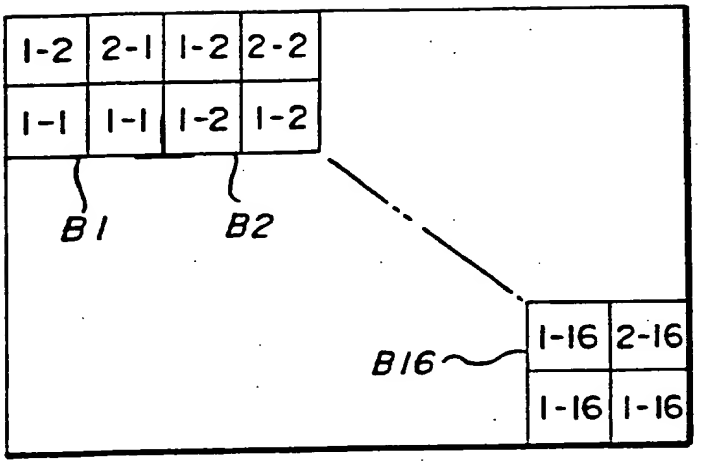

FIG. 5

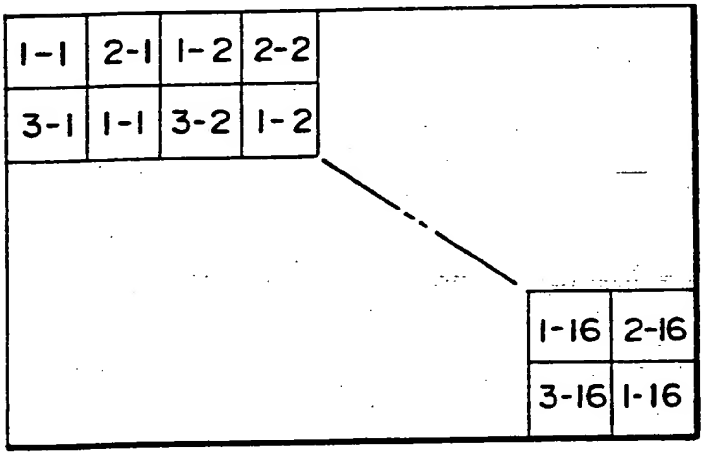

FIG. 6

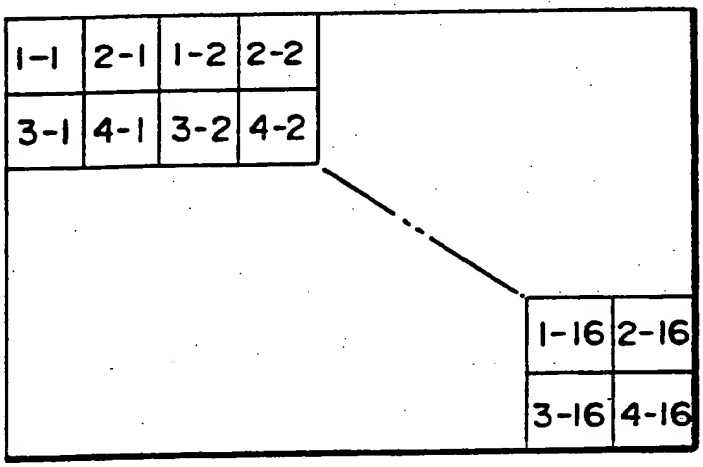

FIG. 7

INTERNATIONAL SEARCH REPORT

PCT/US 91/06614

International Application No.

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 H04N1/21

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	H04N

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	DE,A,3 150 203 (PHILIPS PATENTVERWALTUNG GMBH.) 23 June 1983 see the whole document ---	1-22
A	GB,A,2 216 746 (RICOH CO., LTD.) 11 October 1989 see page 16, line 19 - page 17, line 6 see page 18, line 14 - page 21, line 13 see page 26, line 11 - line 22 see abstract see claims 1,6-8; figure 5 ---	1,3,5, 7-9,12, 13,17,18
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 156 (E-908)(4099) 26 March 1990 & JP,A,2 015 782 (MITSUBISHI ELECTRIC CORP.) 19 January 1990 see abstract --- -/--	1,7,12, 17

* Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
14 FEBRUARY 1992	25. 02. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	F. J. DAALMANS

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 493 (E-697)(3340) 22 December 1988 & JP,A,63 206 084 (HITACHI LTD.) 25 August 1988 see abstract	1,7,12, 17
A	US,A,4 803 554 (PAPE) 7 February 1989 see the whole document	1,7,12, 17
E	WO,A,9 114 334 (EASTMAN KODAK COMPANY) 19 September 1991	1,7,8, 12,17

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 9106614 SA 52925

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 14/02/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-3150203	23-06-83	None	
GB-A-2216746	11-10-89	JP-A- 1231179 DE-A- 3907874	14-09-89 21-09-89
US-A-4803554	07-02-89	None	
WO-A-9114334	19-09-91	None	